Title: SYSTEM AND METHOD FOR MINIMIZING DISPLAY
IMAGE SIZE BY APPROXIMATING PIXEL DISPLAY
ATTRIBUTES
Inventors:        S.P. Proteau et al.
Docket No.:        MSFT119970
U.S. Express Mail No.: EV 291184222 US

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(7) STORE OPTIMIZED
ATTRIBUTE DATA AND
RENDER DIRECTLY TO
REPRODUCE IMAGE

100

CLIENT

102

(1) CONTENT REQUEST

(6) OPTIMIZED
ATTRIBUTE DATA

NETWORK

(2) CONTENT REQUEST

(5) OPTIMIZED
ATTRIBUTE DATA

106

(3) REQUESTED
DISPLAY

SENDING
COMP.

104

(4) OPTIMIZED
ATTRIBUTE DATA

Fig.1.

Fig.3.

TRANSPARENCY
VALUES

RGB COLOR VALUES

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

304

302

300

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200 — START DISPLAY DATA PROCESSING ROUTINE

OBTAIN FIRST IMAGE — 202

204 — OBTAIN DISPLAY ATTRIBUTE FORMAT DATA (FIG. 3)

206 — OBTAIN FIRST PIXEL IN IMAGE

OPTIMIZE PIXEL COLOR VALUE (FIGS. 4 & 5 OR FIGS. 9 & 10) — 208

OPTIMIZE PIXEL TRANSPARENCY VALUE — 210

PIXELS REMAINING ? — 212

OBTAIN NEXT PIXEL

214

YES

NO

TRANSMIT CONTENT DATA — 220

NO

IMAGES REMAINING ? — 216

YES

OBTAIN NEXT IMAGE

218

END — 222

*Fig.2.*

START PALETTE GENERATION ROUTINE — 400

GENERATE PIXEL OCTREE (FIG. 6) — 402

OBTAIN LEAF NODE NUMBER THRESHOLD — 404

LEAF NODES EXCEED THRESHOLD ? — 406

408 — MAP LEAF NODES TO PALETTE

NO

YES

PRUNE OCTREE (FIG. 5) — 410

LEAF NODES EXCEED THRESHOLD ? — 412

YES

NO

INCREASE MERGING THRESHOLD — 414

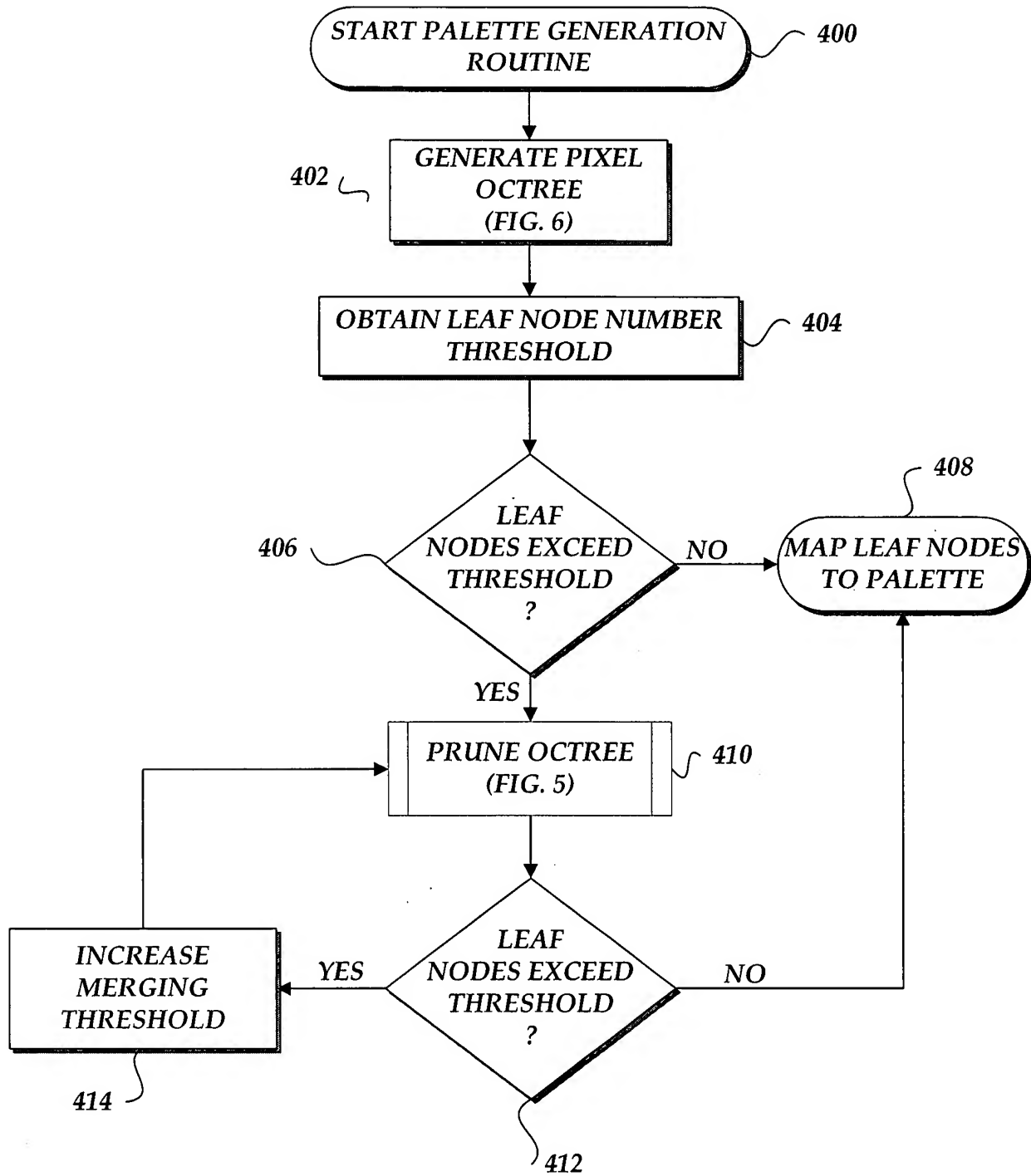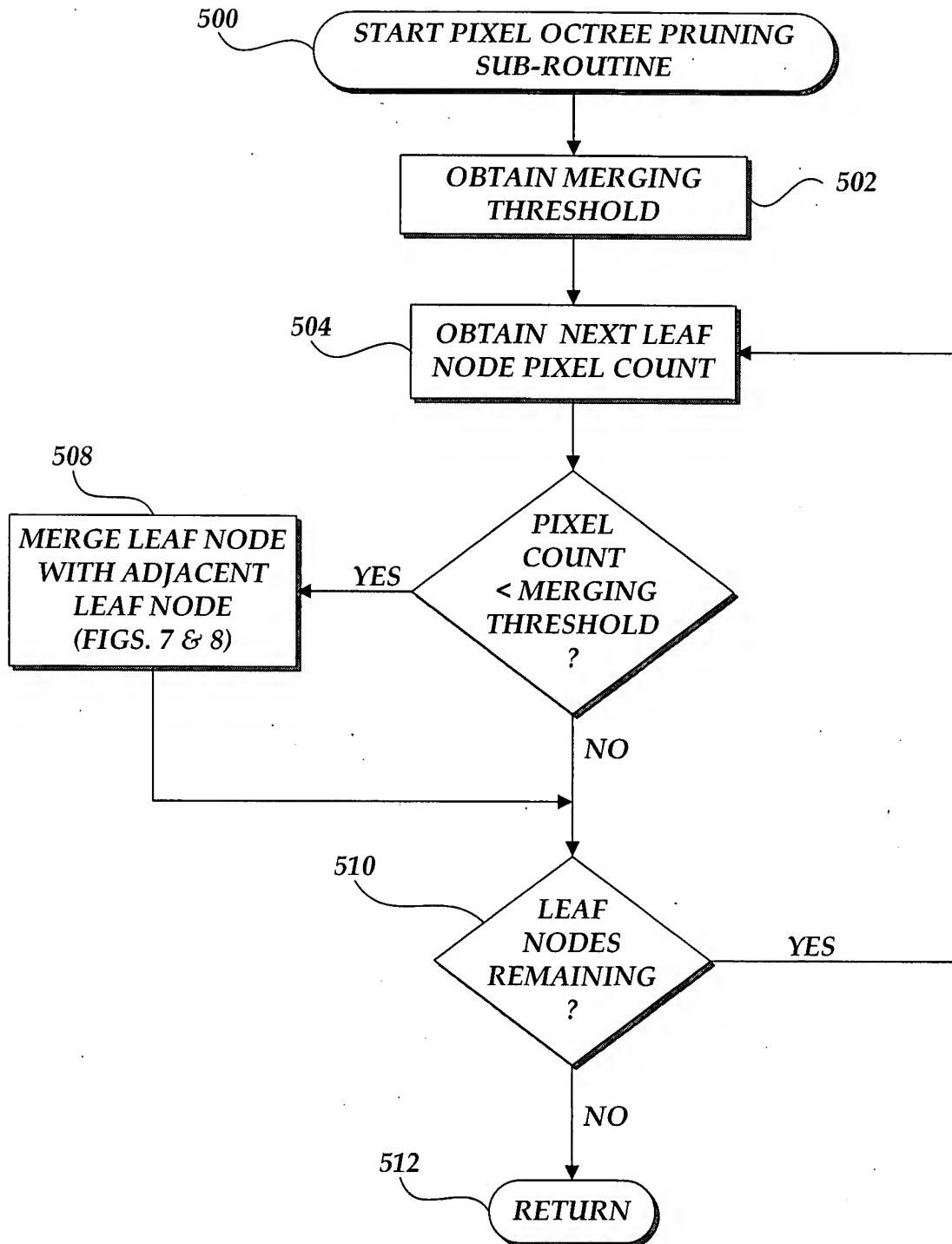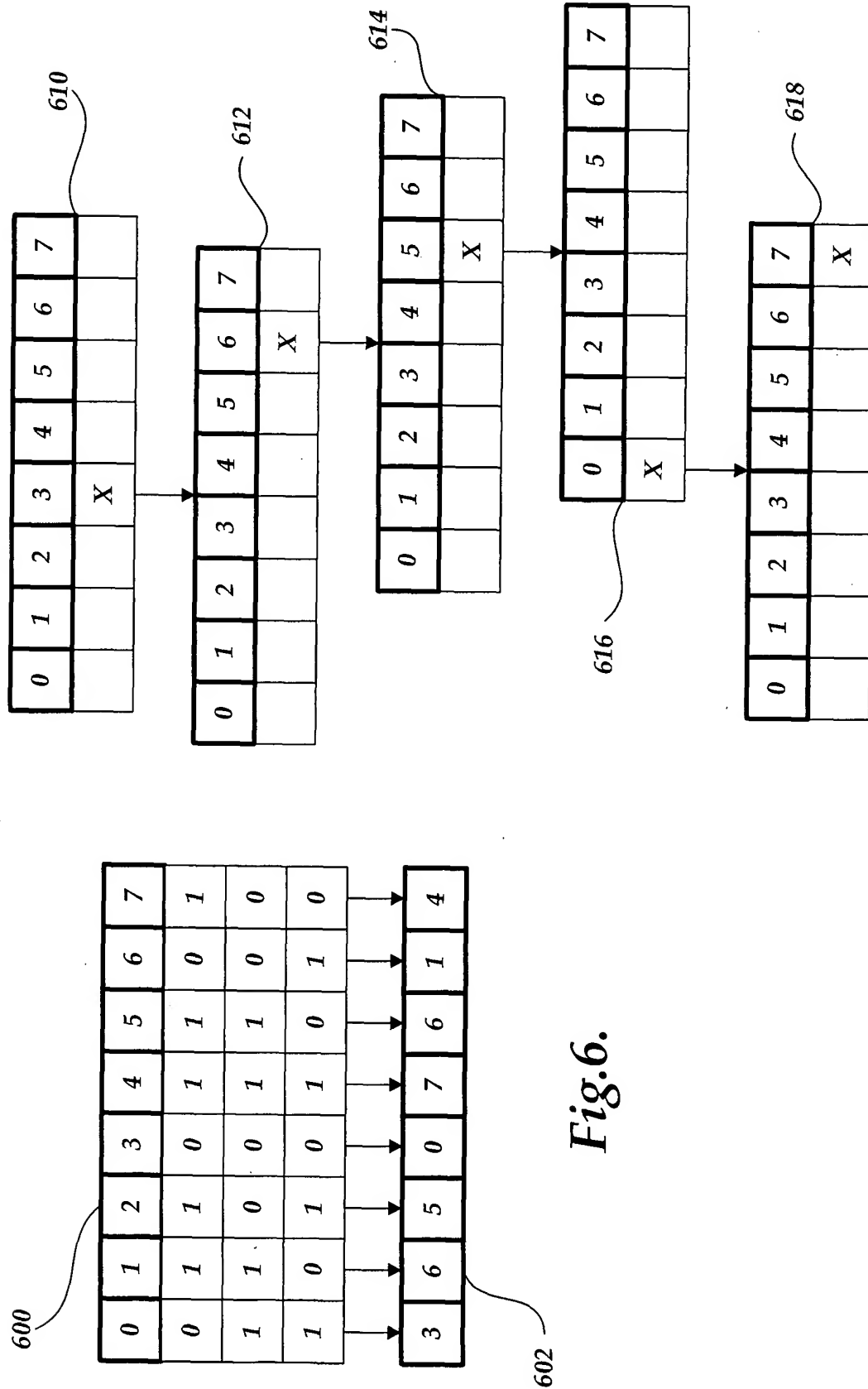*Fig.4.*

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500

**START PIXEL OCTREE PRUNING
SUB-ROUTINE**

502

**OBTAIN MERGING
THRESHOLD**

504

**OBTAIN NEXT LEAF
NODE PIXEL COUNT**

508

**MERGE LEAF NODE
WITH ADJACENT
LEAF NODE
(FIGS. 7 & 8)**

YES

**PIXEL
COUNT
< MERGING
THRESHOLD
?**

NO

510

**LEAF
NODES
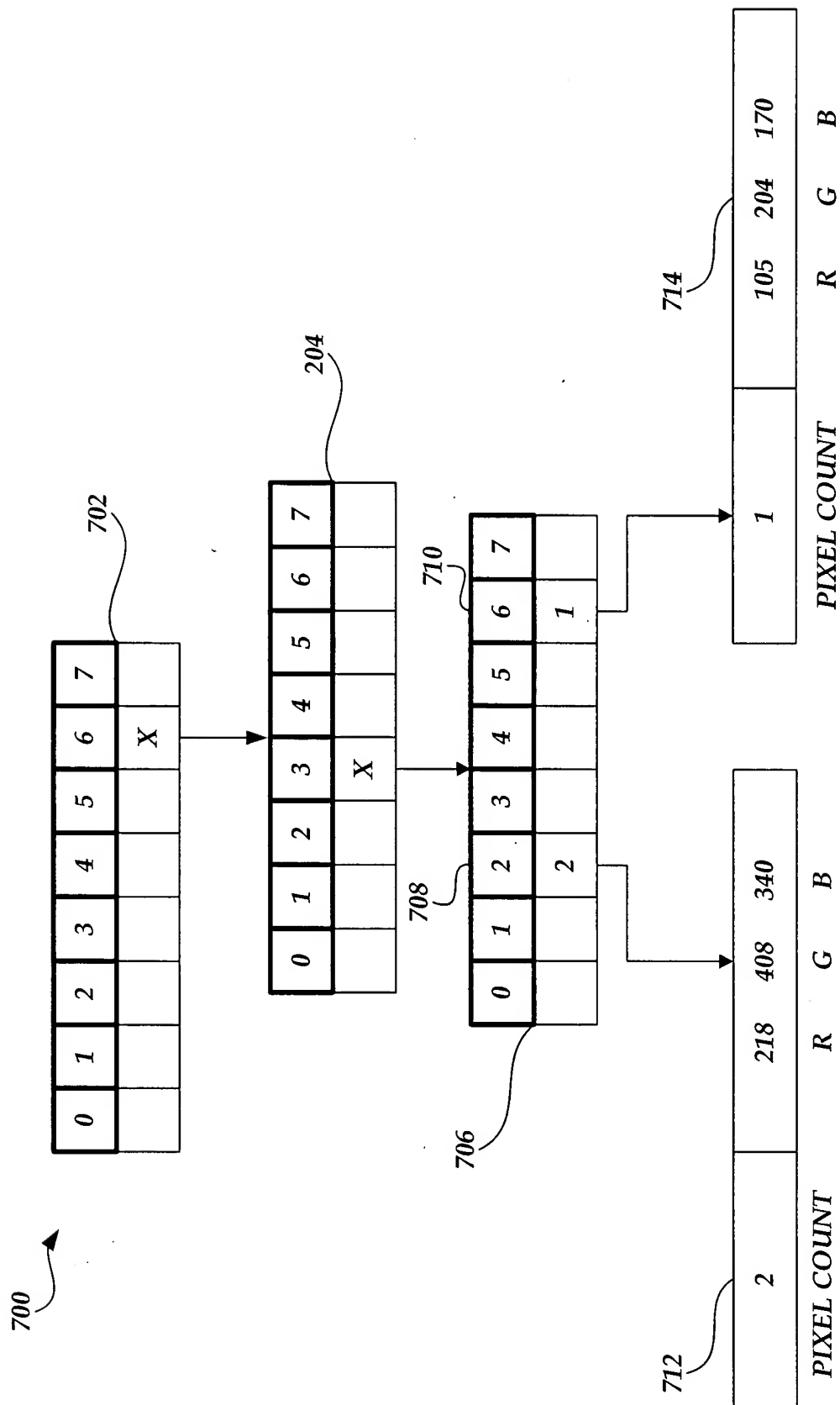REMAINING
?**

YES

NO

512

**RETURN**

Fig.5.

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Fig.6.

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Fig.7.

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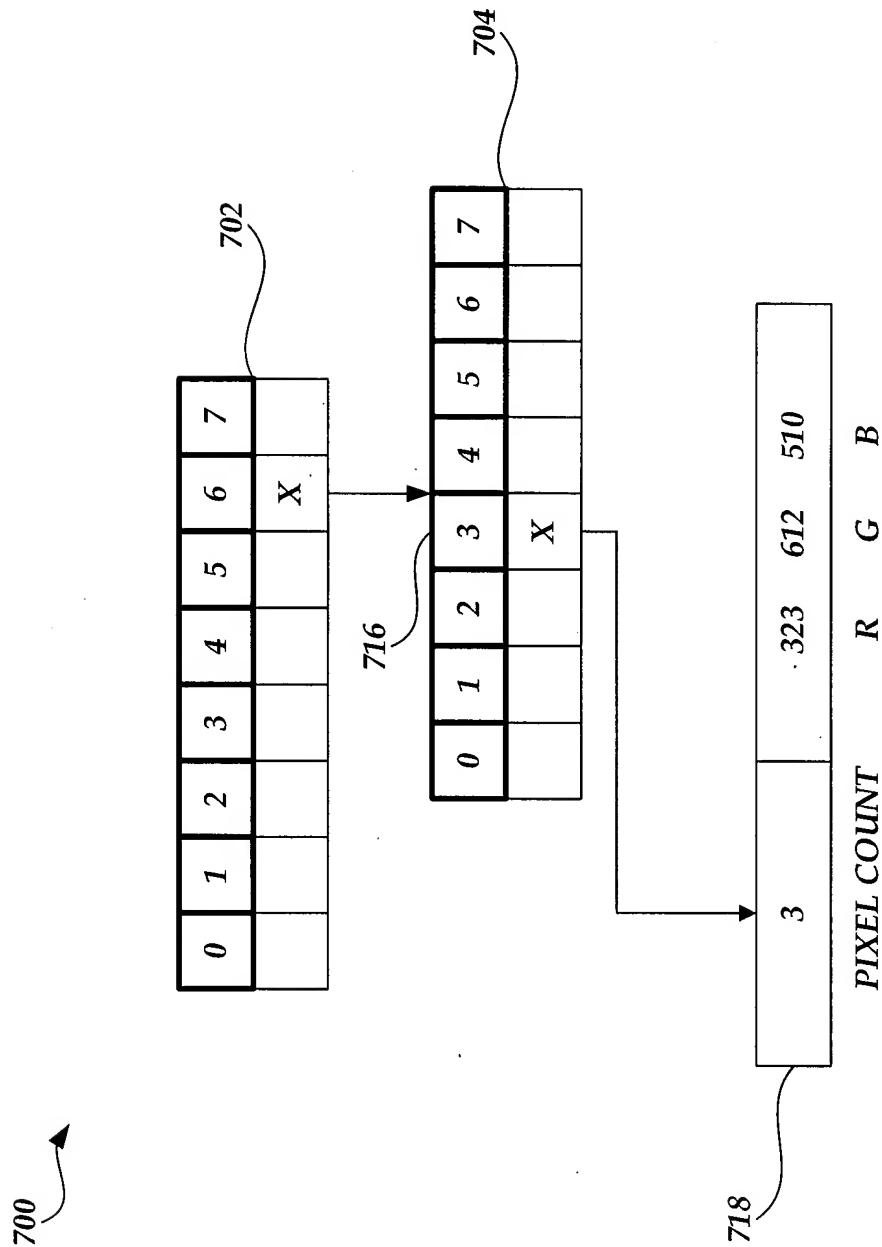
Fig.8.

START PIXEL OCTREE PROCESSING ROUTINE — 900

902 — GENERATE COLOR
OCTREE MAP

OBTAIN LEAF NODE NUMBER THRESHOLD,
MERGING THRESHOLD, & LEAF NODE LOCK
THRESOLD — 904

906 — INITIALIZE PRUNING
ITERATION COUNT

908 — LEAF
NODES EXCEED
THRESHOLD
?

NO — MAP LEAF NODE
COLORS TO COLOR
PALETTE — 910

YES

912 — PRUNE COLOR
OCTREE
(FIGS. 6A & 6B)

B

A

*Fig.9A.*

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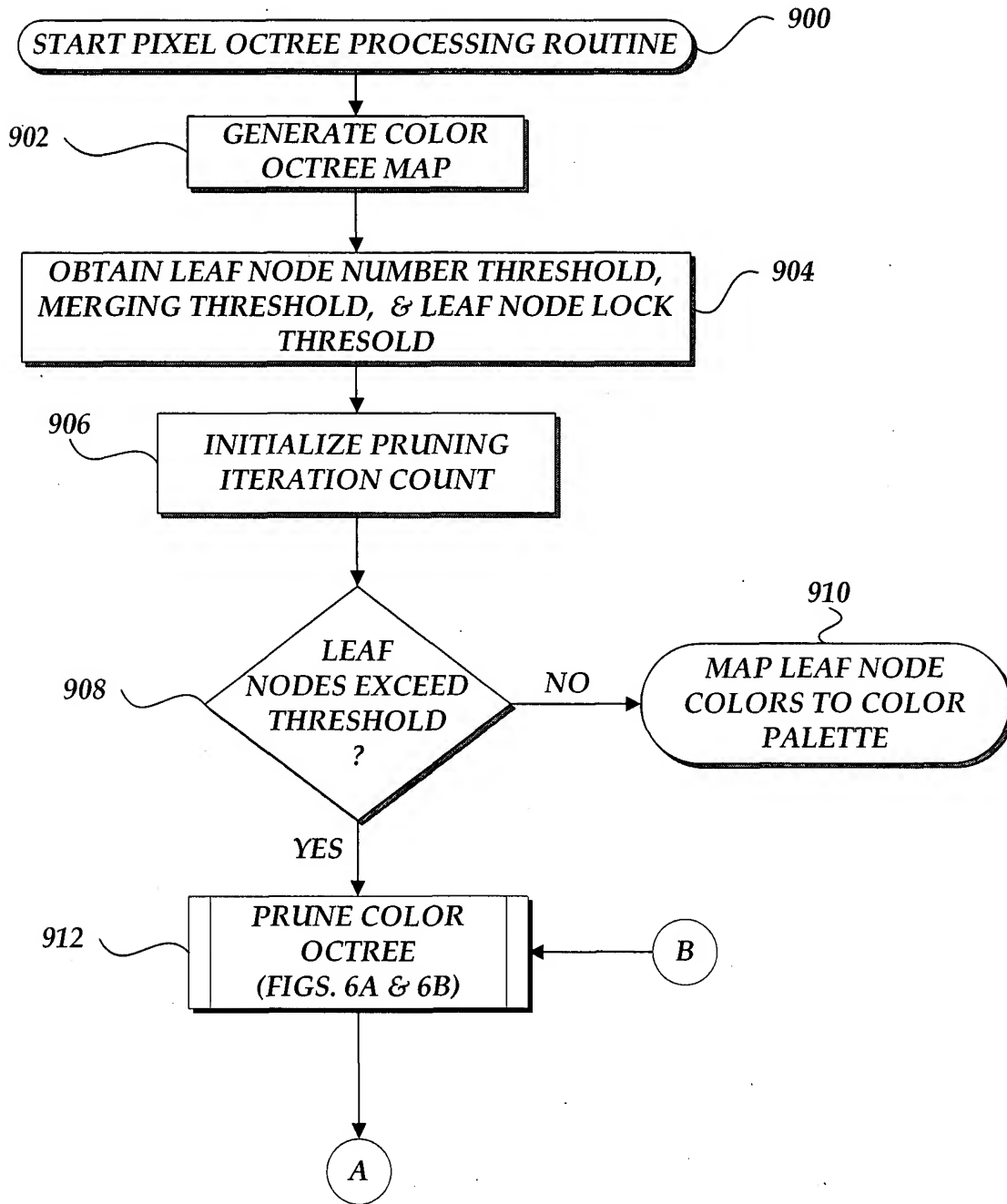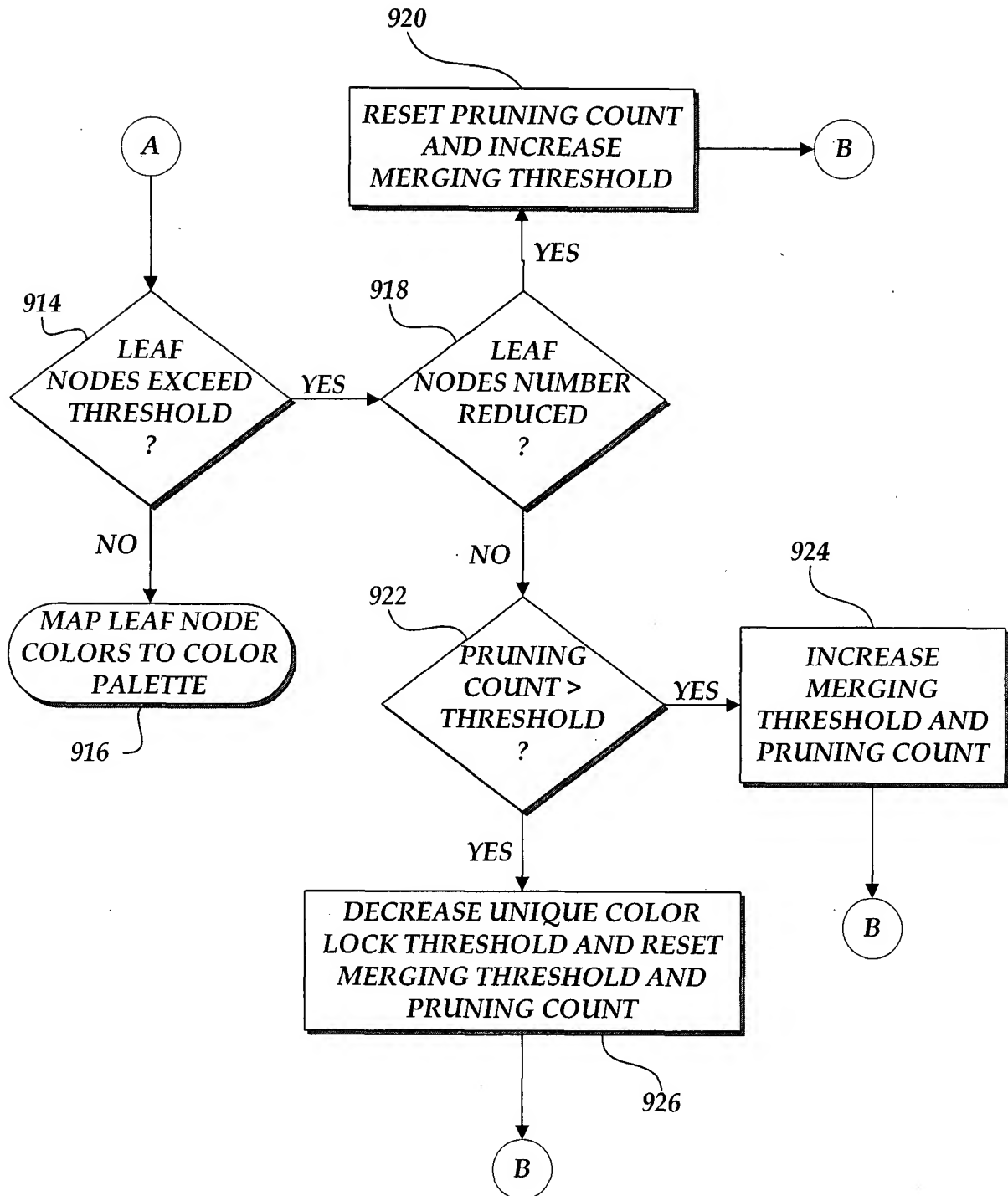U.S. Express Mail No.:  EV 291184222 US

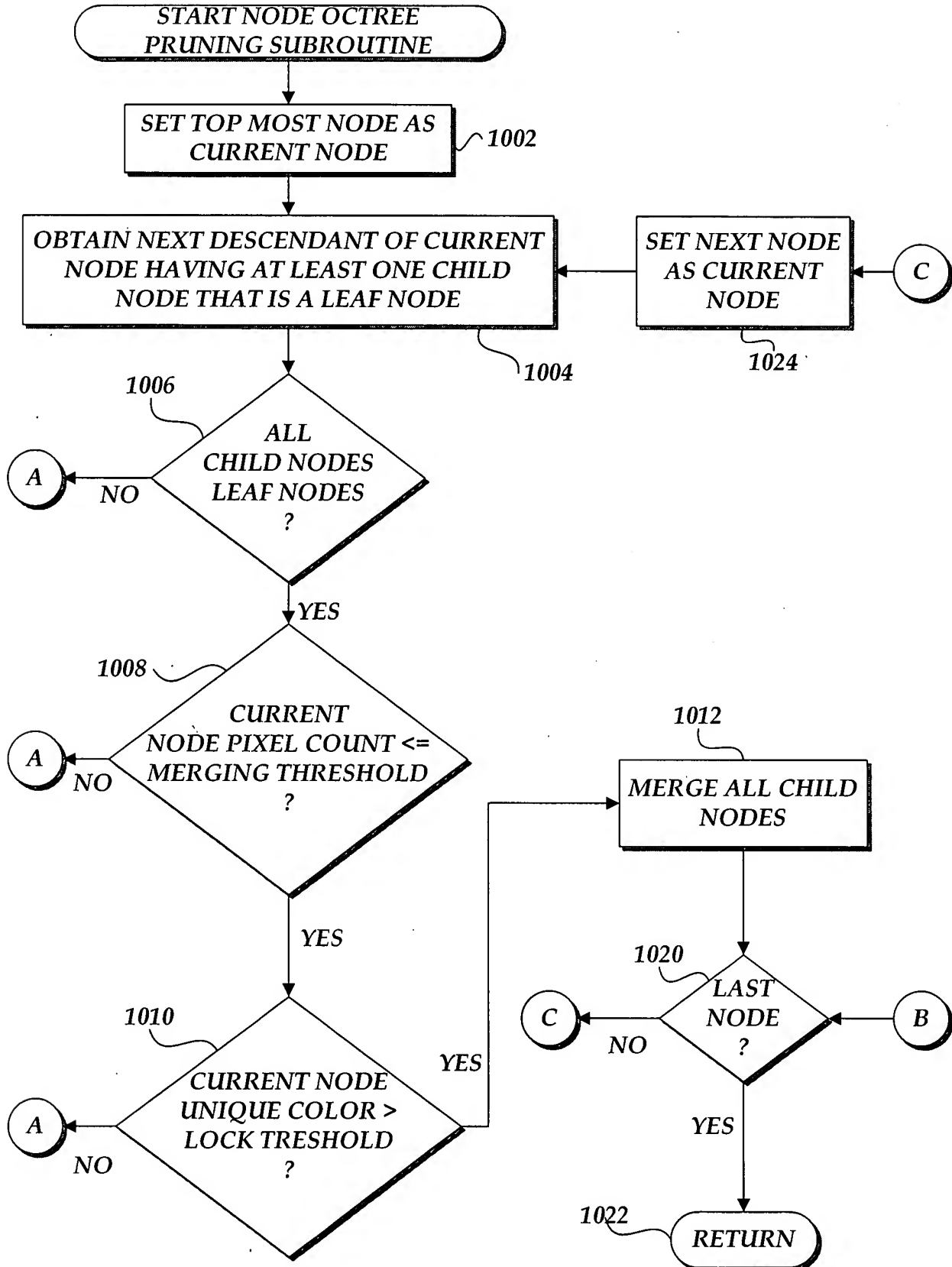9/13

*Fig.9B.*

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START NODE OCTREE
PRUNING SUBROUTINE

SET TOP MOST NODE AS
CURRENT NODE — 1002

OBTAIN NEXT DESCENDANT OF CURRENT
NODE HAVING AT LEAST ONE CHILD
NODE THAT IS A LEAF NODE

1004

SET NEXT NODE
AS CURRENT
NODE

C

1024

1006

ALL
CHILD NODES
LEAF NODES
?

A    NO

YES

1008

CURRENT
NODE PIXEL COUNT <=
MERGING THRESHOLD
?

A    NO

YES

1012

MERGE ALL CHILD
NODES

1010

CURRENT NODE
UNIQUE COLOR >
LOCK TRESHOLD
?

A    NO

YES

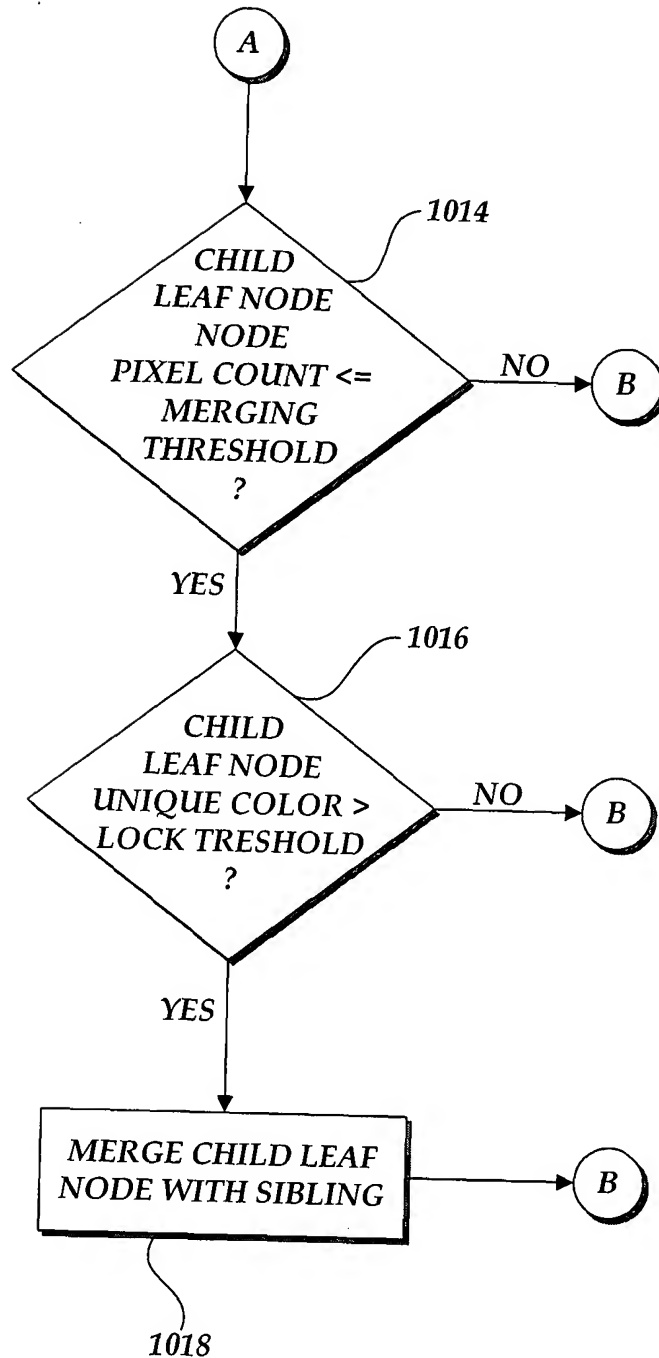1020

LAST
NODE
?

C    NO          B

YES

1022

RETURN

*Fig.10A.*

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A

1014

CHILD
LEAF NODE
NODE
PIXEL COUNT <=
MERGING
THRESHOLD
?

NO → B

YES

1016

CHILD
LEAF NODE
UNIQUE COLOR >
LOCK TRESHOLD
?

NO → B

YES

MERGE CHILD LEAF
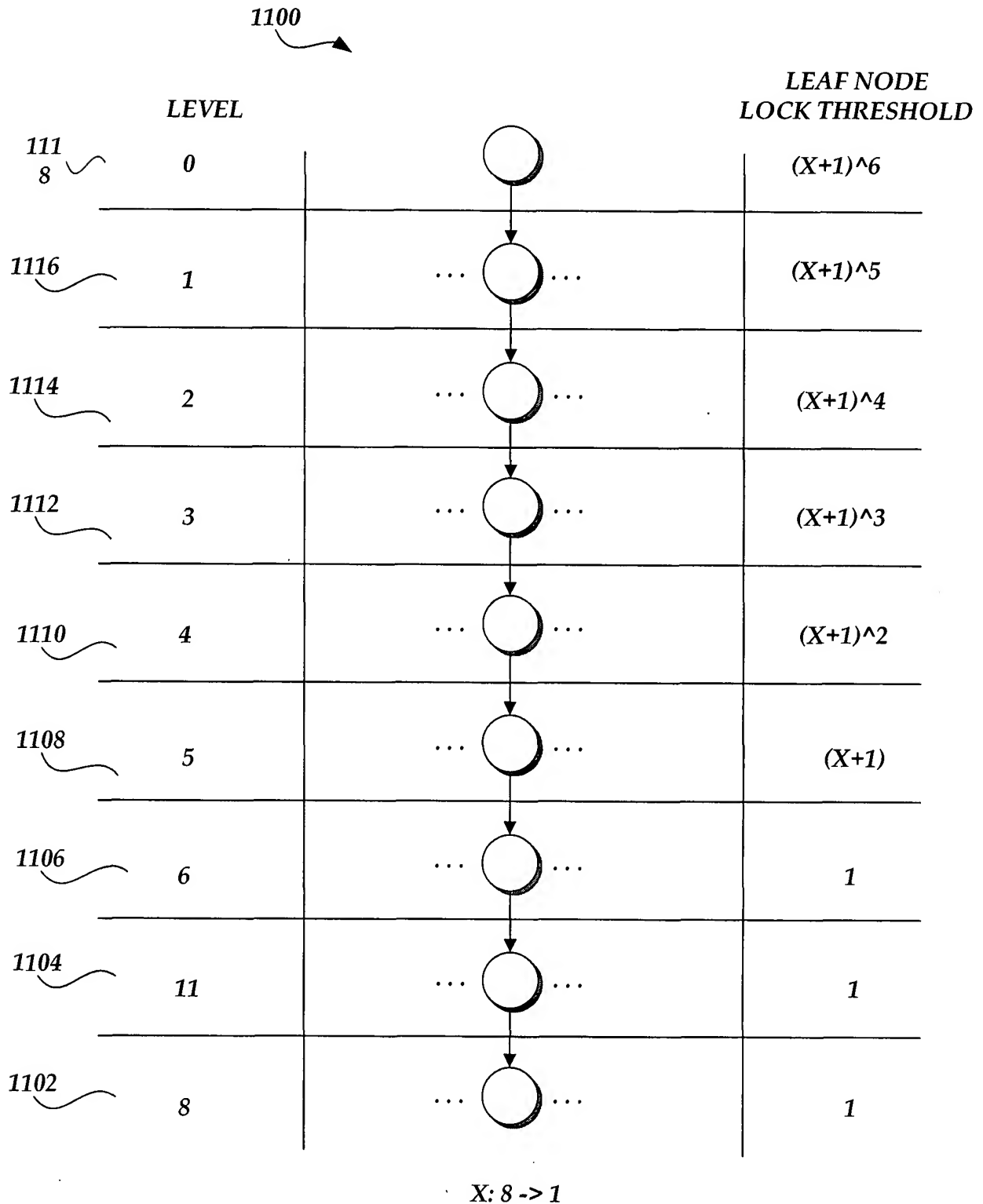NODE WITH SIBLING → B

1018

*Fig.10B.*

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*1100*

| | LEVEL | | LEAF NODE LOCK THRESHOLD |
|---|---|---|---|
| 111 8 | 0 | ◯ | $(X+1)^6$ |
| 1116 | 1 | ⋯ ◯ ⋯ | $(X+1)^5$ |
| 1114 | 2 | ⋯ ◯ ⋯ | $(X+1)^4$ |
| 1112 | 3 | ⋯ ◯ ⋯ | $(X+1)^3$ |
| 1110 | 4 | ⋯ ◯ ⋯ | $(X+1)^2$ |
| 1108 | 5 | ⋯ ◯ ⋯ | $(X+1)$ |
| 1106 | 6 | ⋯ ◯ ⋯ | 1 |
| 1104 | 11 | ⋯ ◯ ⋯ | 1 |
| 1102 | 8 | ⋯ ◯ ⋯ | 1 |

$X: 8 \rightarrow 1$

*Fig.11.*

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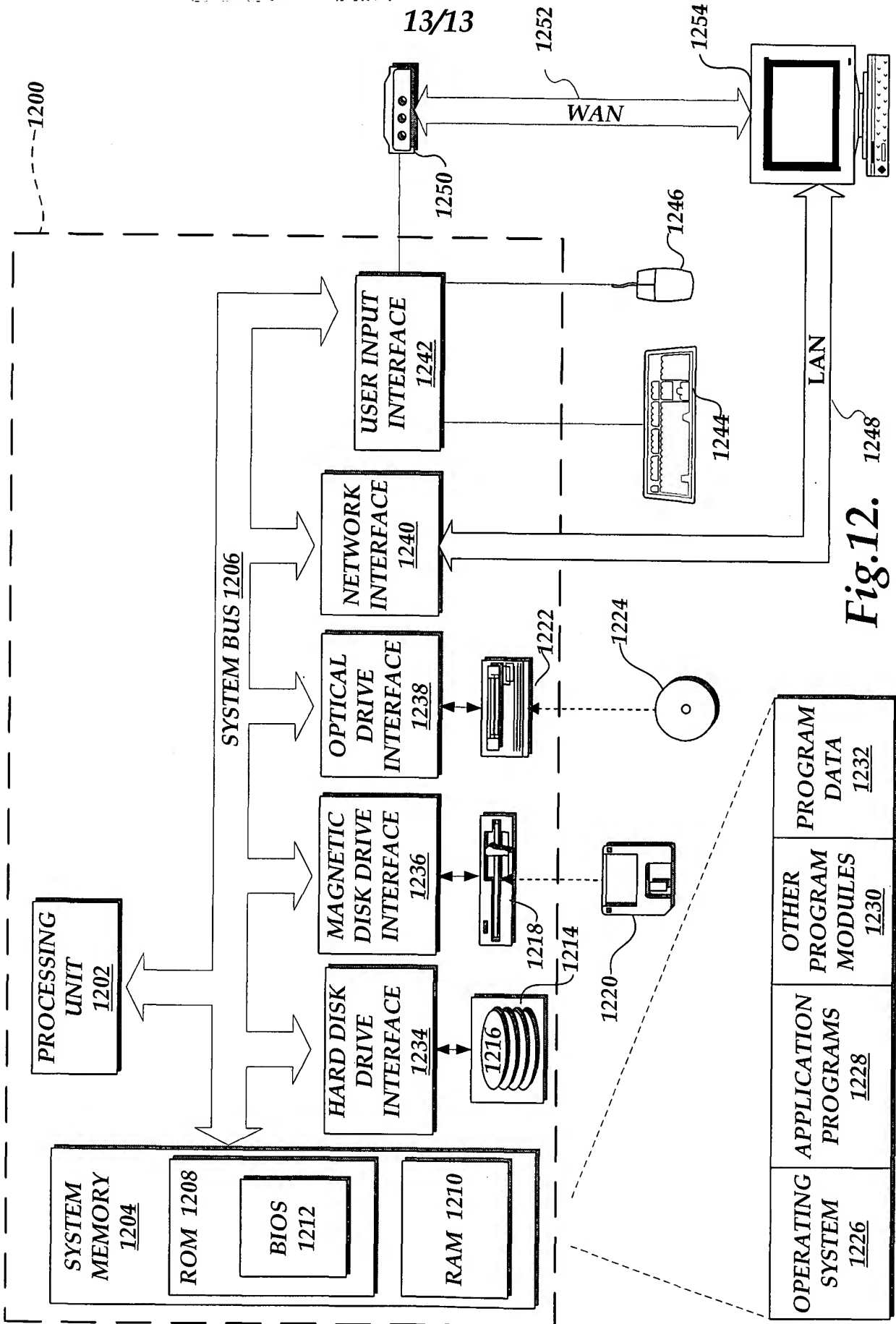U.S. Express Mail No.: EV 291184222 US

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Fig.12.